CO FRA08 Electrical Safety

BNL Risk Team Members: R. Sabatini, A. Bou, R. Chmiel, N. Bernholc, A. Piper, R. Biscardi, S. Mukherji, P. Carr, J. Boccio, J. Curtiss, R. Selvey	**Point Value → Parameter ↓**	**1**	**2**	**3**	**4**	**5**
Names of Chemistry Department Risk Team Members: Diane Cabelli, Greg Hall	**Frequency (B)**	**≤once/year**	**≤once/month**	**≤once/week**	**≤once/shift**	**>once/shift**
Job Title: Electrical Safety **Job Number or Job Identifier: CO-FRA-8**	**Severity (C)**	**First Aid Only**	**Medical Treatment**	**Lost Time**	**Partial Disability**	**Death or Permanent Disability**
Job Description: Work on BNL range A electrical equipment Approved by: Diane Cabelli Date: 5/10/2013 Rev. #: 3	**Likelihood (D)**	**Extremely Unlikely**	**Unlikely**	**Possible**	**Probable**	**Multiple**
Stressors (if applicable, please list all):		**Reason for Revision 1:** Arc Flash accident at C-A **Reason for Revision 2:** EEI program **Reason for Revision 3**: Triennial Review			**Comments:**	

				Before Additional Controls							**After Additional Controls**					
Job Step / Task	**Hazard**	**Control(s)**	**Stressors Y/N**	**# of People A**	**Frequency B**	**Severity C**	**Likelihood D**	**Risk* AxBxCxD**	**Control(s) Added to Reduce Risk**	**Stressors Y/N**	**# of People A**	**Frequency B**	**Severity C**	**Likelihood D**	**Risk* AxBxCxD**	**% Risk Reduction**
Check item to ensure it has a green sticker (approved by BNL qualified EEI inspector) or blue sticker indicating NRTL compliance).	shock	BNL certified inspectors check to ensure that there is suitable grounding, fuses and the equipment meets BNL standards.	N	1	3	2	2	12								

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Operation of disconnects and circuit breakers with the box cover on	Potential arc flash burn (calculations have not been carried out yet)	Cover securely in place, proper grounding, NRTL approved equipment design, Training, PPE	N	1	3	2	2	12	PPE requirements have been reassessed at BNL and made more conservative than the NFPAE requirements. Cuurent guidelines are appended here. An inventory of breakers operating at 450V or higher with greater than 250 amps in also appended. These cannot be operated by and CO employee, regardless of PPE.	N	1	3	1	2	6	50
Zero energy verification on PRESUMED de-energized equipment (Range A and B)	Electrocution, Electrical Shock, Arc Flash Burn	Verified de-energized source, Training, proper grounding, NRTL approved equipment design, BNL standards and procedures, Non-contact voltage sensor for range B equipment, any voltmeter on range A equipment.	N	1	2	5	2	20									
Troubleshooting, testing Low Voltage, Low Current <50 VDC electronic equipment (Range A)	electrical shock, reflex injury	Training, proper grounding, approved equipment design, standards and procedures, covered outputs, workplace precautions	N	1	3	3	2	18									
Inserting or removing electronic modules in slotted crates of NIM, CAMAC, VME, etc. Range A	No hazards if it is properly grounded	Training, proper grounding, approved equipment design, covered outputs, carried out only while crates are deenergized (unplugged)	N	1	3	1	1	3									
Connecting and disconnecting cables between modules and power supplies on electronic systems (eg stepping motors, lamps) (Range A)	Electric Shock, Cuts and abrasions from cables and connectors	Verify de-energized source before connecting, Training, proper grounding, approved equipment design, standards and procedures, proper tools	N	1	3	3	2	18									

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Connecting and disconnecting signal and trigger cables (Range A)	Electrical shock, Cuts and abrasions	Proper grounding, approved design, Proper tools	N	1	3	3	1	9									
Trouble shooting and testing high voltage, low current power supplies (ie ion gauges, vacuum gauges)	Electrocution, electrical shock	Training, proper grounding, NRTL approved equipment design, proper cables and connectors (eg insulated alligator clips), labels and signs, no work on or around energized conductors	N	1	2	5	2	20									
Plugging and Unplugging 110 V electric cords into wall outlets	Electrocution, electrical shock	NRTL approved design, properly rated extension cords.	N	1	5	5	1	25									
Further Description of Controls Added to Reduce Risk: Guidance for PPE required for throwing breakers (taken from Physics). The Face Shield is only a recommendation at the lowest level rated panel. The guidance is universal and likelihood of breakers in 555 is similar that in CO.																	
***Risk:**	**0 to 20 Negligible**	**21 to 40 Acceptable**	**41 to 60 Moderate**						**61 to 80 Substantial**						**81 or greater Intolerable**		

Guidance for PPE required for throwing breakers (taken from Physics). The Face Shield is only a recommendation at the lowest level rated panel. The list of breakers that are rated in the last two categories is given below.

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Typical Panel Rating Sticker

General Electric		
Type NLAB	Style 2	Amp 100
Volts 120/208	PH 3	W4

Any Breaker in a Panel Rated Amp < 225 Volts ≤ 250 3 Phase Common in Physics	Safety Glasses (Face Shield) Cotton Pants Long Sleeved Cotton Shirt Leather-palmed Work Gloves
Any Breaker in a Panel or Stand-alone Switch Rated Amp ≥ 225 Volts ≤ 250 1 or 3 Phase Possible in Physics	Cat. 1 FR Long Pants Cat. 1 FR Long Sleeved Shirt Hard Hat Arc-rated Face Shield All Leather Gloves Hearing Protection
Any Breaker in a Panel or Stand-alone Switch Rated Amp ≥ 225 250 < Volts < 600 1 or 3 Phase Probably not found in Physics	Call Electricians. You are not qualified to operate this switch.

ELECTRICAL SAFETY ALERT

Investigation of the mechanical failure of the GE Spectra Series Switches involved in the Arc-flash incident at B/1006 has found damage on the plastic insulating base on which the internal switch mechanism is mounted. This damage does not appear to be from the arc fault and could have allowed a tensioning clip for the contacts of the switch to fall on the energized bus. Until further notice no one should operate these switches (even with covers on) without an Energized Work Permit signed by an Electrical Engineer knowledgeable in Arc fault calculations or the Laboratory Electrical Safety Officer, Jim Durnan. This will insure appropriate engineering controls and the use of proper PPE to protect against potential injury. See attached picture for GE Switches of concern.